

Amendments to the Claims

Claim 1 (Currently amended): An apparatus for the application of coatings in a vacuum, comprising

at least one filtered arc source comprising at least one cathode contained within a cathode chamber,

at least one anode associated with the cathode for generating an arc discharge,

a plasma duct in communication with the cathode chamber and with a coating chamber containing a substrate holder for mounting at least one substrate to be coated, the substrate holder being positioned off of an optical axis of the cathode,

at least one pair of focusing conductors disposed adjacent to the cathode and the plasma duct, along upstream and downstream sides of the cathode, for focusing a plasma flow from the cathode to the plasma duct,

at least one pair of deflecting-focusing conductors disposed adjacent to the downstream side of the cathode and opposite sides of the plasma duct, generating a deflecting magnetic field for deflecting a plasma flow from the arc source into the plasma duct and a focusing magnetic field for focusing a plasma flow along the plasma duct, the deflecting field coupling with the focusing field in the cathode chamber, and

at least one metal vapor or sputter deposition plasma source ~~disposed in or near a path of the plasma flow,~~ comprising a material to be evaporated and installed in the plasma duct in a region near a center of the at the entrance of a deflecting magnetic field semi-cusp or near a converging area of the focusing magnetic field where the deflecting magnetic field is smallest.

whereby metal vapor propagates toward the substrate along magnetic field lines of the deflecting magnetic field.

Claims 2-26 (Cancelled)

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Claim 27 (New): The apparatus of claim 1 comprising a pair of deflecting conductors disposed adjacent to an upstream side of the cathode, whereby a downstream flow of plasma is generated from the arc source and deflected toward the plasma duct and an upstream flow of plasma is generated from the arc source and deflected away from the plasma duct.

Claim 28 (New): The apparatus of claim 1 wherein the at least one metal vapor plasma source is disposed along an optical axis of the substrate holder.

Claim 29 (New): The apparatus of claim 27 wherein the metal vapor plasma source is disposed near a center of a magnetic cusp created between the upstream and downstream deflecting conductors, in a region where the magnetic field is generally smallest.

Claim 30 (New): The apparatus of claim 29 comprising an electron beam for evaporating the material.

Claim 31 (New): The apparatus of claim 1 wherein the at least one metal vapor plasma source is coupled to the cathode or to the anode and disposed in a line of sight with the substrate holder.

Claim 32 (New): The apparatus of claim 31 wherein the at least one metal vapor plasma source is surrounded by a shield which insulates the at least one metal vapor plasma source from the plasma flow, the shield having an opening to expose material to be evaporated to the plasma flow.

Claim 33 (New): The apparatus of claim 29 wherein an evaporator is disposed between the upstream and downstream plasma flows.

Claim 34 (New): The apparatus of claim 29 wherein an evaporator is disposed in the upstream plasma flow and the material evaporates under the influence of the plasma flow.

Claim 35 (New): The apparatus of claim 34 comprising focusing conductors disposed adjacent to the metal vapor plasma source and the plasma duct on upstream and downstream sides of the metal vapor plasma source, for focusing a plasma flow from the metal vapor plasma source to the plasma duct.

Claim 36 (New): The apparatus of claim 1 wherein impulse lasers are positioned to ignite an impulse vacuum arc discharge on a surface of the cathode.

Claim 37 (New): The apparatus of claim 1 comprising a repelling anode parallel to the plasma duct and installed around the plasma duct near the exit of the plasma duct for directing an ion plasma stream toward the at least one substrate.

Claim 38 (New): The apparatus of claim 36 comprising a repelling anode parallel to the plasma duct and installed around the plasma duct near the exit of the plasma duct.

Claim 39 (New): The apparatus of claim 38 wherein the cathode comprises a non-conductive evaporating material and a power supply is installed between the repelling anode and the cathode.

Claim 40 (New): The apparatus of claim 37 comprising a repelling anode parallel to the plasma duct and installed around the plasma duct near the exit of the plasma duct, and a power supply installed between the repelling anode and the cathode.

Claim 41 (New): The apparatus of claim 35, wherein the metal vapor plasma source is disposed in a plane of symmetry between magnetic cusps of the focusing conductors.

Claim 42 (New): The apparatus of claim 1 wherein the at least one metal vapor plasma source is disposed in a substrate chamber with the substrate holder.

Claim 43 (New): The apparatus of claim 1 wherein the at least one cathode comprises a thermoionic cathode or a hollow cathode.

Claim 44 (New): An apparatus for the application of coatings in a vacuum, comprising

- at least one filtered arc source comprising at least one cathode contained within a cathode chamber,
- at least one anode associated with the cathode for generating an arc discharge,
- a plasma duct in communication with the cathode chamber and with a coating chamber containing a substrate holder for mounting at least one substrate to be coated, the substrate holder being positioned off of an optical axis of the cathode,
- at least one pair of focusing conductors disposed adjacent to the cathode and the plasma duct on upstream and downstream sides of the cathode, for focusing a plasma flow from the cathode to the plasma duct,
- at least one pair of deflecting-focusing conductors disposed adjacent to the cathode and the plasma duct, generating a deflecting magnetic field for deflecting a plasma flow from the arc source into the plasma duct and a focusing magnetic field for focusing a plasma flow along the plasma duct, the deflecting magnetic field coupling with focusing magnetic field of the cathode chamber, and
- at least one metal vapor or sputter deposition plasma source comprising a material to be evaporated, positioned off of an optical axis of the coating chamber and installed in the cathode chamber in a region at the entrance of a focusing magnetic field semi-cusp or near a converging area of the focusing magnetic field where the magnetic field is smallest, and
- at least one pair of focusing conductors disposed adjacent to the metal vapor source and the plasma duct on upstream and downstream sides of the cathode, for focusing a plasma flow from the metal vapor source to the plasma duct,

whereby metal vapor propagates toward the substrate along magnetic field lines of the deflecting magnetic field.

Claim 45 (New): The apparatus of claim 44 wherein the at least one metal vapor plasma source is disposed in the coating chamber in opposition to the filtered arc source.

Claim 46 (New): The apparatus of claim 45 comprising an electron beam for evaporating the material.

Claim 47 (New): The apparatus of claim 44 wherein the at least one metal vapor plasma source is coupled to the cathode or the anode and disposed off of an optical axis of the substrate holder.

Claim 48 (New): The apparatus of claim 47 wherein the metal vapor plasma source comprises a heated evaporated anode surrounded by a shield which insulates the metal vapor plasma source from the plasma flow, the shield having an opening to expose material to be evaporated to the plasma flow.

Claim 49 (New): The apparatus of claim 47 wherein the metal vapor plasma source comprises a heated evaporated cathode.

Claim 50 (New): The apparatus of claim 47 wherein the metal vapor plasma source comprises a heated evaporated anode.

Claim 51 (New): The apparatus of claim 47 wherein the sputter deposition plasma source comprises a magnetron source.

Claim 52 (New): The apparatus of claim 44 comprising a deflecting anode and a repelling anode for directing an ion plasma stream toward the at least one substrate.

Claim 53 (New): The apparatus of claim 52 comprising at least one power supply installed between the cathode and either the deflecting anode or the repelling anode.

Claim 54 (New): The apparatus of claim 53 comprising at least one grounded deflecting anode.

Claim 55 (New): The apparatus of claim 53 comprising a power supply installed between ground and the repelling anode.

Claim 56 (New): The apparatus of claim 53 wherein impulse lasers are positioned to ignite an impulse vacuum arc discharge on a surface of the cathode.

Claim 57 (New): The apparatus of claim 38 wherein the cathode comprises a non-conductive evaporating material and a power supply is installed between the repelling anode and the cathode.

Claim 58 (New): The apparatus of claim 47 wherein at least one cathode comprises a thermoionic cathode or a hollow cathode.

Claim 59 (New): The apparatus of claim 47 wherein the at least one metal vapor plasma source is disposed in a substrate chamber with the substrate holder.

Claim 60 (New): A method of coating an article in a coating apparatus comprising at least one filtered arc source comprising at least one cathode contained within a cathode chamber, at least one anode associated with the cathode for generating an arc discharge, a plasma duct in communication with the cathode chamber and with a coating chamber containing a substrate holder for mounting at least one substrate to be coated, the substrate holder being positioned off of an optical axis of the cathode, at least one deflecting-focusing conductor disposed adjacent to the plasma source and the plasma duct, for deflecting a plasma flow from the arc source into the plasma duct, and at least one metal vapor or sputter deposition plasma source installed in the plasma duct in a region near a center of the deflecting magnetic field semi-cusp where the deflecting magnetic field is smallest, such that metal vapor propagates toward the substrate along magnetic field lines of the deflecting magnetic field, the method comprising the steps of:

- a. generating an arc between the cathodic arc source and the anode to create a plasma of cathodic evaporate,
- b. evaporating or sputtering a material in the metal vapor plasma source or sputter deposition plasma source to generate a metal vapor or sputter flux in the vicinity of the plasma flow,
- c. ionizing the metal vapor generated by metal vapor or sputter source, and
- d. generating a deflecting magnetic field for deflecting a flow of the plasma toward the substrate holder,

whereby the flow of plasma mixes with the metal vapor or sputter flux prior to coating the at least one substrate.

Claim 61 (New): The method of claim 60 wherein the metal vapor plasma source or sputter deposition plasma source is disposed in or near the flow of plasma.

Claim 62 (New): The method of claim 60 including after step c. the step of focusing the metal vapor plasma or sputter plasma prior to deflecting the metal vapor plasma or sputter plasma into the plasma duct.

Claim 63 (New): The method of claim 60 wherein the metal vapor plasma source is coupled with the cathode or the anode for ionization of the metal vapor.

Claim 64 (New): The method of claim 60 wherein the repelling electrode is installed surrounding the plasma duct near an exit of plasma duct.

Claim 65 (New): The method of claim 64 including after step d. the step of repelling ions toward the substrate chamber.

Claim 66 (New): A method of coating an article in a coating apparatus comprising at least one filtered arc source comprising at least one cathode contained within a cathode chamber, at least one anode associated with the cathode for generating an arc discharge, a plasma duct in communication with the cathode chamber and with a coating chamber containing a substrate holder for mounting at least one substrate to be coated, the substrate holder being positioned off of an optical axis of the cathode, at least one deflecting conductor disposed adjacent to the plasma source and the plasma duct, for deflecting a plasma flow from the arc source into the plasma duct, at least one metal vapor or sputter deposition plasma source installed in the cathode chamber off of a line of sight with the coating chamber, at least one pair of focusing conductors disposed adjacent to the metal vapor source and the plasma duct on upstream and downstream sides of the cathode, for focusing a vapor plasma flow from the metal vapor source to the plasma duct, the focusing and deflecting magnetic field overlapped, the metal vapor source installed in a region near a center of the focusing magnetic field semi-cusp where the focusing magnetic field is smallest, such that metal vapor plasma propagates toward the substrate along magnetic field lines of the focusing and deflecting magnetic field, the method comprising the steps of:

- a. generating an arc between the cathodic arc source and the anode to create a plasma of cathodic evaporate,
- b. evaporating or sputtering a material in the metal vapor plasma source or sputter deposition plasma source to generate a metal vapor or sputter flux in the vicinity of the plasma flow,
- c. ionizing the metal vapor generated by metal vapor or sputter source,
- d. generating a focusing magnetic field for focusing a flow of the metal vapor plasma or sputter plasma toward plasma duct, and
- e. generating a deflecting magnetic field for deflecting a flow of the cathodic arc plasma and/or metal vapor plasma toward the substrate holder,

whereby the flow of plasma mixes with the metal vapor plasma or sputter plasma flux prior to coating the at least one substrate.

Claim 67 (New): The method of claim 66 wherein the metal vapor plasma source is coupled with the cathode or the anode for ionization of the metal vapor.

Claim 68 (New): The method of claim 66 wherein a thermoionic cathode or hollow cathode is activated after step b. for ionization of the metal vapor plasma.

Claim 69 (New): The method of claim 66 wherein the deflecting and/or repelling electrodes are installed along plane of symmetry of plasma duct.

Claim 70 (New): The method of claim 69 wherein the repelling electrode is installed surrounding the plasma duct near an exit of the plasma duct.

Claim 71 (New): The method of claim 69 including after step c. the step of repelling ions toward the substrate chamber.

Claim 72 (New): The method of claim 70 including after step c. the step of repelling ions toward the substrate chamber.

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